REMARKS/ARGUMENTS

Claims 1 to 6 remain in the present application and no amendments have been made to these claims at this time.

Claim Rejections – 35 USC § 103(a)

The Examiner rejected claims 1 to 3 as obvious over Yamamoto (US 4,690,867) in view of Vayda (US 4,762,811) and Callis (US 2,502,418). Reconsideration of this rejection is requested for the following reasons.

The intent of the present invention is to protect unfired refractories containing calcium silicate from attack by molten aluminum or molten magnesium. This is achieved by adding a barium- or strontium-containing compound to the slurry mix, molding, dewatering and treating the product hydrothermally.

The Examiner has argued that Yamamoto teaches the formation of such a product, but is silent as to the use of barium- or strontium-containing compounds, and drying. However, according to the Examiner, Vayda teaches barium sulfate powder mixed with calcium silicate and Callis teaches drying.

Yamamoto is concerned with the production of a refractory for contacting low melting point metals, but does not mention problems caused by reaction of the metal with the refractory. Instead, Yamamoto is concerned with providing the refractory with crack-resistance while avoiding the use of asbestos fibers. A double-layer structure is provided, with the metal-contacting part having no fibers or a reduced amount. The refractory has a xonotlite structure (fibrous crystals of aluminosilicate material) produced by introducing xonotlite slurry into the mixture.

Vayda relates to refractories containing zinc borosilicate frit (a glassy component) used to prevent corrosion on contact with aluminum. According to the disclosure of Vayda in Column 1, lines 18 to 25, the frit prevents penetration of molten aluminum into the refractory, but does not affect the problem of adhesion of the aluminum and it has the disadvantage of decreasing the load bearing properties of the refractory. To overcome these problems of the prior art, Vayda adds barium sulfate (barite) to the zinc borosilicate frit in fine powder form and then uses the combination as an anti-adhesive agent for refractory

compositions (Col. 1, lines 43 to 52). The teaching of Vayda is therefore that barium sulfate should be used in combination with zinc borosilicate frit in order to overcome some of the disadvantages of the use of the frit. There is no teaching that barium sulfate would be useful alone (without the presence of zinc borosilicate frit). Indeed, Vayda at Column 1, lines 26 to 30 states (in discussing the prior art):

> Others such as in U.S. Pat. No. 4,126,474 have added barium sulfate to the refractory in an effort to overcome these problems but it not only does not eliminate adherence of the metal to the refractory, but also tends to lower the load-bearing properties of the refractory.

This statement clearly teaches away from the use of barium sulfate for refractories, except when used in combination with zinc borosilicate frit. Indeed, it seems that the relative proportions or amounts of bariums sulfate and frit is critical. For example, at the end of Examples 1 to 3 in Column 3 of Vayda, the following statement is made:

> These results show that despite increasing amounts of barite there was strong adherence of the aluminum alloy to the refractory after cup testing.

This seems to indicate that barium sulfate, if not used with sufficient frit, does not have a desirable effect, at least on aluminum adherence. Similarly, it is stated in Column 6 at the end of Examples 10 to 13 that:

> It was necessary to utilize at least 4% zinc borosilicate to avoid adherence.

On the other hand, Examples 14 to 17 seem contradictory and confusing. The first paragraph of these examples in Column 6 states that the examples are to show the poor load resistance of the refractories when using frit alone or barite alone, but the refractory of Example 17 (which contains barite but without frit) seems to pass the load subsistence test, but with only moderate metal penetration. Despite the positive result, the overall effect of Example 17 (as far as it can be understood) is to teach away from the use of barite alone.

Accordingly, a person skilled in the art would see no reason to combine the teachings of Yamamoto (which makes no mention of the use of barium sulfate nor zinc borosilicate frit) and Vayda (that requires the presence of such frit and barium sulfate in certain proportions

for operability) to create a composition that includes barium sulfate (without frit) to improve resistance to attack by molten metal. Indeed, Vayda teaches away from such a combination because it discourages the use of barium sulfate alone in refractory compositions.

The Examiner combined the above two references with Callis on the basis that Callis teaches drying. While Callis does mention drying (Col. 4, lines 24 to 34), the product of Callis is different from that of Yamamoto (and also the present invention) as it relates to fibers bonded by a product of an alkali metal aluminate and an alkaline earth oxide. There is consequently no silicate, which is characteristic of both Yamamoto and the present invention. Also, there is no suggestion in Callis that of a subsequent hydrothermal treatment (the blocks of Callis are dried by heating to elevated temperature), so the drying of Callis is not a step in a process that is equivalent to that of Yamamoto or the present invention. It is therefore not seen that Callis is relevant nor can it be combined with Yamamoto or Vayda as it shows but a single step in a process that is quite different from either that of Yamamoto or Vayda.

The Examiner also rejected claims 1, 2 and 4-6 as being obvious over Yamamoto in view of Pryor, Jr. (US 6,407,023) and Callis. The Examiner alleged that Prior teaches a barium compound mixed with calcium silicate (Kaolin clay) and the other references teach the features mentioned above, so that it would be obvious to combine these references to come up with the present invention. Again, reconsideration is requested.

Prior discloses a process that requires a firing step (exposure to a temperature of at least 2,650°F (1,455°C) for at least 30 minutes. Yamamoto (and the present invention) relates to an unfired product. These processes and products are not equivalent because the firing step radically changes the solid structure of the refractory and hence produces a different class of materials that do not have the same or similar properties. A person skilled in the art would not see Prior as relevant to Yamamoto (or the present invention) simply because of this difference of the intended product. As stated in Column 8, line 61 to Column 9, line 2 of Prior:

> Referring now to the heating stage of the process of the present invention, i.e., the transformation of the mixture to a refractory grain, the mixture undergoes several physical changes during firing, namely (1) a dehydration phase; (2) a dehydroxylization phase; (3) a metakaolination phase; (4) a reaction between the barium- and/or strontium-containing compounds and free silica and, if present, other impurities in the alumino-silicate source; and (5) recrystallization of the metakaolin into mullite.

Thus, not only does Prior rely on the use of an aluminosilicate (rather than an alkaline earth metal silicate as in Yamamoto and the present invention), it is clear that the firing step causes reaction between the barium- or strontium-containing compounds and the aluminosilicate. Thus the product is different from an unfired refractory. A person skilled in the art would know that a material that reacts in this way would not react in the same way in an unfired refractory. Hence there would be no reason or motivation to combine the teaching of Prior with that of Yamamoto.

As for the Examiner's reliance on Callis, this has been discussed above and this reference seems no more relevant in combination with Prior and Yamamoto that it did in combination with Vayda and Yamamoto.

For the above reasons, favorable reconsideration and allowance of this application are requested.

Respectfully,

Christopher C. Dunham

Christopher C. Dunham
Reg. No. 22,031
Attorney for Applicants
Tel. (212) 278-0400

I hereby certify that this paper is being deposited this date with the U.S. Postal Service as first class mail addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Christopher C. Dunham

Christopher C. Dunham
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